Marine Bioacoustics: Soundtracks for the future

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LONG-TERM GOALS

The primary goal of our project is to provide advanced undergraduates, graduate students, and postdoctoral investigators with a broad understanding of ocean acoustics as well as the techniques used to study the ecology of marine animals *in situ*. By bringing together many of the top researchers in marine bioacoustics, biological oceanography, and marine biology, we provide students with a unique opportunity to work side by side with world experts using state-of-the-art tools and technologies. A secondary goal of the project is to provide a setting for developing and testing new technologies. In this manner, it serves as a research magnet, attracting leading scientists to conduct their own research in a creative teaching and learning environment that catalyzes interactions across the various disciplines associated with Bioacoustical Oceanography.

OBJECTIVE

To provide students with a broad understanding of the acoustic techniques used to study the distribution and behavior of marine animals in the context of their physical/chemical/biological environment.

APPROACH

Through lectures, demonstrations, and field exercises, we provide students with a unique opportunity to learn and work side by side with top scientists using state-of-the-art bioacoustic tools and techniques. During winter courses, we provide students with hands-on opportunities to investigate passive acoustic methods for studying humpback whale ecology. During spring/summer courses, we provide students 1.) with a strong conceptual understanding of marine bioacoustics theory through lectures and laboratory exercises, and 2.) practical hands-on experience through field experiments and cruises.

WORK COMPLETED

During the winter course, field studies were conducted along the Kohala Coast of Hawaii Island to demosnstrate methods to the students. In the laboratory, students were taught how to localize and track

vocalizing humpback whales with data collected the previous year using Wave Gliders. Students were also taught how to analyze and classify sounds using the Raven software package.

During the spring course, students were exposed to an intensive course that focused on active acoustics, both traditional fisheries/zooplankton acoustics and tracking of acoustically tagged fish. Students were taught how to conduct forward problem comparisons of zooplankton abundance estimates from plankton nets versus echo sounders. Students were also given comprehensive training in the Echo View software package.

RESULTS

One paper has been published (Greene et al, 2014), one paper is in press (Meyer-Gutbrod, 2015), and one manuscript is in preparation by a student enrolled in the spring course (Fiorenza et al., in prep.).

Greene, C.H., et al. 2014. A Wave Glider approach to fisheries acoustics: transforming how we monitor the nation's commercial fisheries in the 21st century. Oceanography: 27(4): 168–174.

Meyer-Gutbrod, E., C.H. Greene, A.J. Pershing, and P. Sullivan. Climate-associated changes in prey availability drive reproductive dynamics of the North Atlantic right whale population. Marine Ecology Progress Series (in press).

IMPACT

Students from around the world come to these courses because they provide the best training available in Marine Bioacoustics. The student participants from this year bring our total number of students since 1993 up to 313 students from 32 different countries. Alumni from our courses have become national and international leaders in the fields of Marine Bioacoustics and Bioacoustical Oceanography, and we are now training the second generation of students in this field (training the students of our former students).

In addition to our educational accomplishments, the PI, postdoc, and graduate student supported partially on this grant have achieved two iportant research results during the past year. First, we have quantitatively demonstrated that climate-driven, decadal-scale ecosystem regime shifts are the most important factor regulating the recovery of the North Atlantic right whale population. Second, we demonstrated that Wave Gliders can provide an effective platform for acoustically monitoring pelagic marine ecosystems on a continental scale.

RELATED PROJECTS

New NSF proposal to continue Wave Glider research is pending.